

# Transport and biodegradation of chlorinated ethenes in a fractured dolomite aquifer near Niagara Falls, New York

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A combination of hydrogeological, geochemical and microbiological methods was used to document the biotransformation of trichloroethene (TCE) to ethene by naturally-occurring microorganisms under anaerobic conditions in a fractured dolomite aquifer. Biodegradation rates of TCE and its metabolites were estimated through solute transport simulations in which reaction constants were adjusted through nonlinear regression to minimize the difference between computed concentrations of chlorinated ethenes and concentrations measured before and during 5 years of pump-and-treat remediation. Ground-water velocities in the solute transport models were computed from hydraulic-head distributions obtained with three-dimensional flow simulations representing conditions before and during pumping, which began operation in 1993.

Transport simulations indicate that the information provided concerning the hydrogeology and contaminant distributions at the site is sufficient to demonstrate that the chlorinated ethene plume in April 1998 had reached a dynamic equilibrium between the rate of TCE dissolution from a DNAPL source and the rate of removal through pumping and biodegradation. The principal sources of uncertainty in estimating biodegradation rates, and in predicting the fate of chlorinated ethenes at the site, are estimates of fracture porosity (ground-water velocity) and the mass of DNAPL remaining near the contaminant source, a former neutralization pond.